FABRIC IN ASPHALT OVERLAYS APPLIED OVER BRICK ROADWAY

PROJECT NY 82-7

F-000S(39); M-000S(39)

CITY OF JAMESTOWN

CHAUTAUQUA COUNTY

EDWARD J. ZACK, MATERIALS ENGINEER

REGIONAL INVESTIGATOR

FINAL REPORT

JUNE, 1990

82-07

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

EXPERIMENTAL PROJECT REPORT

EXPERIMENTAL PROJECT

EXPERIMENTAL PROJECT NO. [1]: STATE NY | YEAR 82 | NUMBER 07 | SUF. —
CONSTRUCTION PROJ. NO. [8]: F-000S (39), M-000S (39)
LOCATION [28]: Chautauqua County

EVALUATION FUNDING [48]: 1 ☐ HP&R 3 ☐ DEMONSTRATION 2 ☒ CONSTRUCTION 4 ☐ IMPLEMENTATION
NEEP NO. [49]:
PROPRIETARY FEATURE? [51]: ☐ YES ☒ NO

SHORT TITLE

TITLE [52]: Fabric In Asphaltic Overlays Applied Over Brick Roadway

THIS FORM

DATE [140]: MO. 06 – YR. 90
REPORTING [144]: 1 ☐ INITIAL 2 ☐ ANNUAL 3 ☒ FINAL

KEY WORDS

KEY WORD 1 [145]: Pavement Asphalt
KEY WORD 2 [167]: Overlays
KEY WORD 3 [189]: Reflective Cracks
KEY WORD 4 [211]:
UNIQUE WORD [233]: Non-Woven polypropylene
PROPRIETARY FEATURE NAME [255]:

CHRONOLOGY

Date Work Plan Approved: MO. YR. [277]	Date Feature Constructed: MO. YR. [281]	Evaluation Scheduled Until: MO. YR. [285]	Evaluation Extended Until: MO. YR. [289]	Date Evaluation Terminated: MO. YR. [293]
10 – 82	09 – 83	09 – 86	09 – 89	–

QUANTITY AND COST

QUANTITY OF UNITS *(Rounded to whole numbers)* [297]: 6480
UNITS [305]: 1 ☐ LIN. FT. 5 ☐ TON; 2 ☒ S.Y. 6 ☐ LBS.; 3 ☐ S.Y.-IN. 7 ☐ EACH; 4 ☐ C.Y. 8 ☐ LUMP SUM
UNIT COST *(Dollars, Cents)* [306]: 1.66

AVAILABLE EVALUATION REPORTS

[315]: ☒ CONSTRUCTION ☐ PERFORMANCE ☒ FINAL

EVALUATION

CONSTRUCTION PROBLEMS [318]: 1 ☐ NONE 2 ☒ SLIGHT 3 ☐ MODERATE 4 ☐ SIGNIFICANT 5 ☐ SEVERE
PERFORMANCE [319]: 1 ☐ EXCELLENT 2 ☐ GOOD 3 ☒ SATISFACTORY 4 ☐ MARGINAL 5 ☐ UNSATISFACTORY

APPLICATION

[320]: 1 ☐ ADOPTED AS PRIMARY STD. 2 ☐ PERMITTED ALTERNATIVE 3 ☐ ADOPTED CONDITIONALLY 4 ☒ PENDING 5 ☐ REJECTED 6 ☐ NOT CONSTRUCTED
(Explain in Remarks if 3, 4, 5, or 6 is checked)

REMARKS

[321] After seven years, all test sections are continuing to provide excellent performance. The fabric reinforced sections have not performed any better than the non-fabric reinforced control sections.

[700]

FORM FHWA 1461 (REV. 8-79) Previous Editions are Obsolete

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FABRIC IN ASPHALT OVERLAYS APPLIED OVER BRICK ROADWAY

CITY OF JAMESTOWN

CHAUTAUQUA COUNTY

PROJECT NY 82-07

F-000S(39); M-000S(39)

INTRODUCTION

Geotextiles have gained increasing recognition and acceptance for use as a deterrent to reflective cracking in asphalt concrete overlays. Many installations exist in connection with asphalt concrete overlays on portland cement or asphalt concrete pavements.

The subject experimental project provided an opportunity to install and monitor geotextile interlayer effectiveness with an asphalt concrete overlay on an existing brick pavement.

PROJECT

N.Y.S. Contract D250315 - Intersection Improvement, City of Jamestown, Chautauqua County, New York.

FA Project F-000s(39); M-000s(39); Experimental Project NY 82-07 (Portion of main project only).

Letting Date February 3, 1983; Experimental work completed various dates summer of 1983.

GENERAL

The construction contract provided for widening, repaving and signalization at various isolated intersections in the City of Jamestown to improve traffic operations and capacity. Also included were two short blocks (700'+/- total) of brick pavement which were to be resurfaced for ride quality improvement. It was this two block length which was chosen for the experimental project.

All paving and resurfacing on this project specified the use of a geotextile membrane.

PROJECT NY 82-07 (Refer to map attachment "A")

General

A two-block (700' +/-) segment of 6th Street between Main Street and Washington Avenue in the City of Jamestown was chosen for the experimental work. This 32' wide brick pavement serves as a segment of the westbound portion of a two-way couple for N.Y.S. touring Rte. 394 through the City.

The original design typical section provided for brick pavement cleaning; tack coat (Item 407.0101*); variable depth machine-laid leveling course (Item 403.21*); 1 1/2" Asphalt Concrete Binder Course Type 3 (Item 403.13*) finished with a 1 1/2" Asphalt Concrete Top Course Type 7F (Item 403.19*). (See Typical Section Attachment "B").

The geotextile fabric was to be placed between the binder and top courses (Item 91410.51 - Non-Woven Polyproplene Membrane -See Attachment "C").

To provide for the study, the following modifications were made to the plan typical section:

1) As a Control section, the membrane was omitted on the south side of 6th Street between Cherry Street and Washington Avenue.

2) The membrane was placed directly on the brick pavement on the north side of 6th Street between Cherry Street and Washington Avenue. (Case A)

3) Placement of membrane between Cherry Street and Main Street was as called for in the design typical section, i.e., between binder and top courses. (Case B)

4) Although deemed desirable, the intended placement of membrane between the leveling course and binder course was abandoned due to complexities in scheduling, paving, traffic control and other project equipment demands.

*Item numbers refer to NYS Standard Specifications, January 2, 1981 and current addenda thereto

Condition of Existing Pavement

The existing brick pavement was in general, sound but extremely irregular in surface profile both longitudinally and transversly. Variances on the order of 3/4" to 1 1/2" in 10' were not uncommon. Additionally, a relatively large area of concrete patch existed as a wearing course diagonally curb to curb approximately midway between Cherry Street and Washington Avenue.

After cleaning and brooming, the mortar joints between the bricks were found to be voided to an average depth of approximately 3/8". The brick surface was polished and extremely dense in appearance.

Materials

Geotextile Membrane - Fibretex AO as manufactured by Crown Zellerbach.

Asphalt Sealant (Contract Option) - Cationic Asphalt emulsion GR CRS-2 in accordance with N.Y.S.D.O.T. Item 702.4101*.

Equipment

As per Specification (see Attachment "C")

Weather

Little wind was evident and partly cloudy conditions prevailed. Air temperature was 70 degrees F. and rising with a relative humidity of 65%. The pavement was damp in the early morning due to overnight dew but dried off sufficiently to begin work by mid-morning.

Construction - Membrane on Brick Segment

In addition to an inordinate amount of hand brooming, especially around drop inlets, pavement irregularities, valve boxes, curb radii, etc. two passes of the power broom were required to clean the pavement sufficiently for emulsion application.

After some experimentations, an application rate of 0.22 gal/sy of CRS-2 emulsion was determined to be the desired target value. This provided not only excellent fabric "retention", but also filled the voided mortar

*Item numbers refer to NYS Standard Specifications, January 2, 1981 and current addenda thereto

joints in the brick completely. Application temperature of the emulsion was as per the specification, 130 degrees F. Some minor hand spraying was necessary, particularly adjacent to the curbing and at the radius of intersections to adequately cover the surface.

Under the prevailing conditions, actual emulsion "break time" was 25 minutes.

The geotextile membrane was installed from a roll of material suspended on a 3" diameter pipe carrying frame attached to the front end of a 3/4 c.y. bucket loader. "Home built" for this project only, this system worked remarkably well and trouble free. The membrane was placed with a minimum of effort, broomed and rolled with a Buffalo-Springfield PSR-15 roller.

Due to the unevenness of the brick pavement surface however, it was impossible to avoid numerous wrinkles which had to be hand cut and patched together. Large amounts of hand cutting, fitting and placing were also necessary at the intersection radius areas.

After rolling of the membrane, the hot mix asphalt concrete leveling course (1" nominal depth) was placed over the membrane in the conventional manner. Mat temperature ranged between 285 degrees - 305 degrees F. The paver was a Barber-Greene SB-140 with electronic grade control. Compactive effort was by Rex 1100 vibratory roller.

Construction - Membrane between Binder and Top Course Asphalt Concrete

All features were as above except:

1) The ideal target application rate of the CRS-2 emulsion was found to be 0.35 gal/s.y.

2) The geotextile membrane placement was accomplished virtually wrinkle-free due to the smoothness of the newly laid asphalt concrete surface.

COMMENTS AND OBSERVATIONS

1) Considering that the operations, material and technique required were new to all concerned, the project in actuality went off quite well. As the project progressed, productivity increased and all operations tended to run increasingly smooth.

2) The placement of the membrane in a heavily trafficked, relatively narrow urban area short block is cumbersome and

tends to be extremely labor intensive. The contract bid price for geotextile membrane in place including sealant on this project was $1.65 P.S.Y. Contractor has indicated that his actual cost was over $5.00 P.S.Y. Such a cost, if actually required to be paid, would seem to dramatically affect any cost effectiveness of the installed system.

3) Wrinkles in the geotextile membrane were unavoidable on this project where the membrane was laid directly on the brick, due to the irregular nature of the brick pavement surface. All other factors being equal (including degree of reflective cracking-retardance), it would seem preferable to place the geotextile membrane on a smooth asphalt concrete surface, either leveler or binder course, or on cement concrete pavement. Where fabric was placed on newly paved asphalt concrete binder course, wrinkles were not a problem but tended to appear, if at all, at the longitudinal extremities of the fabric. They appeared to be a function of roll width as their prevalence was markedly reduced where narrower rolls were of necessity utilized.

4) Fibretex AO was well suited to the purpose on this project; it laid into the sealant well, showed excellent absorption, exhibited little or no "tracking" under construction traffic and adhered tenaciously to the underlying course.

5) It was found expeditious to begin placement of the geotextile membrane into the emulsions sealant at the first indication of "break", particularly where heavy amounts of hand work were required. Once the emulsion "break" began, it continued rapidly and if placement was not begun soon enough, areas resulted where the sealant became too hard for adequate absorption and bond by the membrane.

6) A leveling course asphalt concrete placement directly on brick was made immediately longitudinally adjacent to the segment where membrane was placed on the brick pavement. After compaction, the underlying brick "waffle" course was visible in shadow pattern in the area where no membrane was placed. No shadow pattern was visible in the membrane areas.

7) This project affords the opportunity to observe membrane-pavement-reflective cracking interactions in a number of placement conditions within the same contract; membrane on brick, membrane on binder over brick and membrane on existing asphalt concrete (over brick and portland cement concrete base). Upon completion, no visible signs of any differential behaviors or appearances amongst the various installations could be noted. No unusual problems other than noted above were encountered in the construction or behavior of any section. No slipping or sliding was evident in any situation.

A total 6,488 s.y. of geotextile membrane was installed on this project. Of this total, 2,774 s.y. was installed on the 6th Street portion, and of that total, 446 s.y. were placed directly on the brick pavement.

EVALUATION:

Project condition was monitored on an annual basis, over the past seven (7) years. Visual observations were noted and interim reports (FHWA-146) filed as required.

FINDINGS:

1. The interim reviews conducted during 1984 indicated that no difference between Case A, B or Control sections was noted.

2. Additionally, no cracking of any type was noted.

3. The 1985 interim review indicated no difference between Case A, B. or Control sections.

   However, a single longitudinal reflective crack developed along the Control section approximately 20' in length with a single transverse crack at each end, 6- 8' in length projecting perpendicularly across into the Case A section. The configuration was that of an elongated "U" and actually mirrored or reflected a concrete patch in the underlying brick pavement.

   The vertical face of the patch actually protruded approximately 1/2" above the adjacent brick, no transition leveler was used during the pavement preparation.

   This heavy stress point reflective crack is plotted on the attached map (indicated in red).

   No additional cracking of any type was noted at this time.

4. During the interim reviews of 1986 to the present, no additional cracking was noted and no difference between Case A, B or Control is evident.

CONCLUSIONS:

1. After almost seven (7) years of service, all sections are performing identically.

2. All sections are continuing to provide excellent performance.

3. The fabric reinforcement failed to make any significant improvement in preventing the advancement of reflection cracking in a brick pavement.

4. The fabric reinforced sections have not performed any better than the non-fabric reinforced (control) sections.

RECOMMENDATIONS:

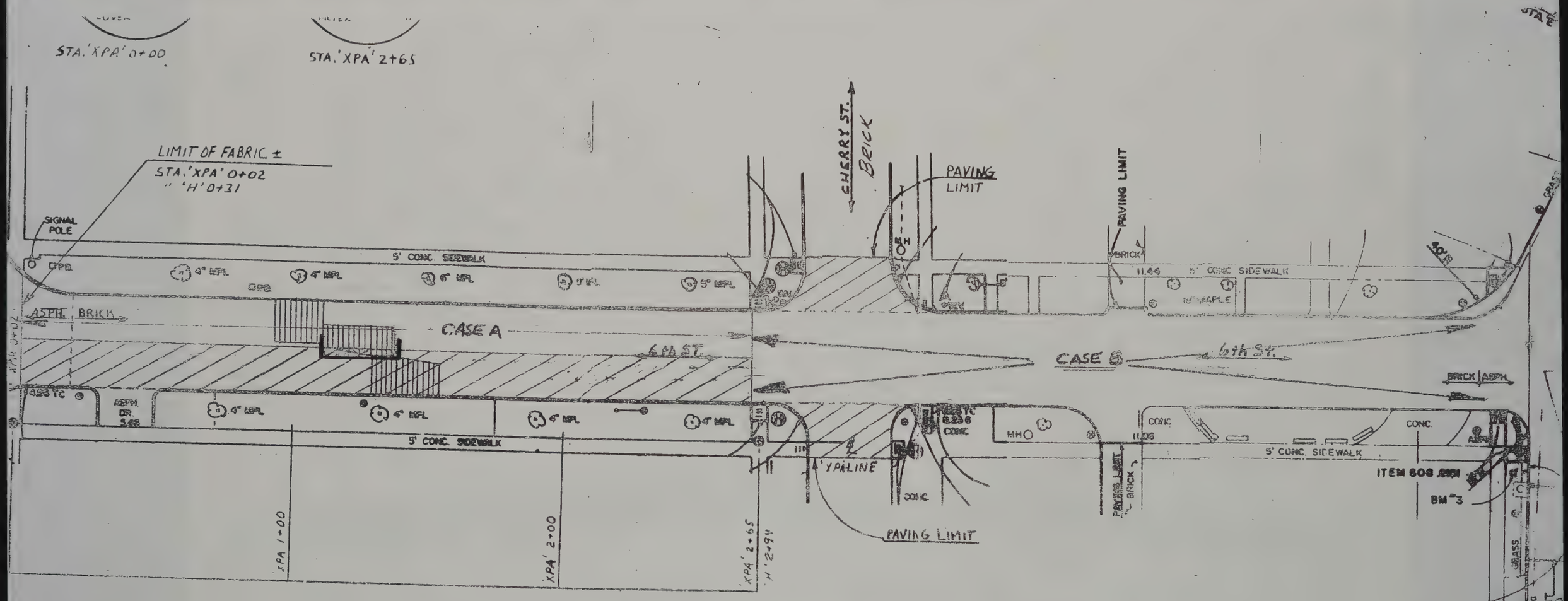
On the basis of this single installation, the additional costs incurred in the preparation and placement of fabric reinforcement have not been transmitted into an equivalent gain in service life.

Whether seven (7) years is a sufficient evaluation period is unknown and perhaps at some point in the future, a more definitive difference may be evident.

We therefore would recommend that the use of fabric reinforcement over brick pavement not be considered a general alternative to conventional overlay rehabilitation techniques.

ACKNOWLEDGEMENTS

Thanks are extended to personnel of the L. C. Whitford Co., Wellsville, New York for their cooperation in progressing the project. Additionally, S. Medley, C.E. I, Engineer-In Charge, and T. Krauza, T.C.I. III, provided invaluable assistance in data gathering and project field control. The study was conducted under the supervision of I. J. Pecnik, Associate Civil Engineer, now employed by the Strategic Highway Research Program.



— OMIT NONWOVEN POLYPOPYLENE MEMBRANE

— EXIST. CONCRETE PAV'T. PATCHING

6th STREET

City of Jamestown

D250315 · NY 02-07

F000S(39) — M000S(39)

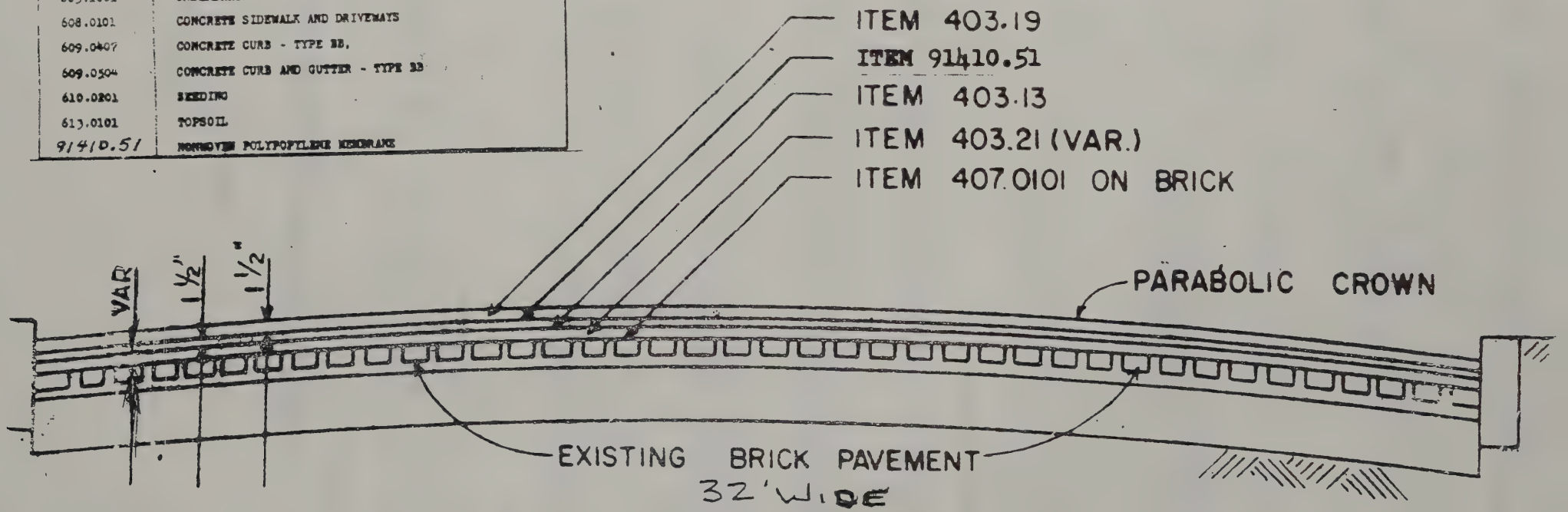
CASE A - FABRIC PLACED DIRECTLY ON BRICK

CASE B - FABRIC PLACED BETWEEN BINDER & TOP

ATTACH A

Attach B

ITEM NO.	DISCRIPTION
203.02	UNCLASSIFIED EXCAVATION AND DISPOSAL
206.02	TRENCH AND CULVERT EXCAVATION
304.02	SUBBASE COURSE, TYPE I
403.19	ASPHALT CONCRETE - TYPE 7F, TOP COURSE (M.F.)
403.11	ASPHALT CONCRETE - TYPE 1, BASE COURSE
403.13	ASPHALT CONCRETE - TYPE 3, BINDER COURSE
403.21	ASPHALT CONCRETE - TRUING AND LEVELING COURSE
407.0101	TACK COAT, EMULSIFIED ASPHALT
18605.060401	CORRUGATED POLYETHYLENE UNDERDRAIN PIPE - 4 INCH DIA.
605.1001	UNDERDRAIN FILTER - TYPE 2
608.0101	CONCRETE SIDEWALK AND DRIVEWAYS
609.0407	CONCRETE CURB - TYPE BB,
609.0504	CONCRETE CURB AND GUTTER - TYPE BB
610.0201	SEEDING
613.0101	TOPSOIL
91410.51	NONWOVEN POLYPROPYLENE MEMBRANE



6TH ST. BETWEEN MAIN ST. & WASHINGTON ST.

91410.51 - NONWOVEN POLYPROPYLENE MEMBRANE

DESCRIPTION

Under this Item, the Contractor shall supply and place a Nonwoven Polypropylene Membrane in accordance with these specifications at the locations shown on the plans or as directed by the Engineer.

MATERIALS

1. The Asphalt Sealant shall be applied to the existing road surface prior to application of the fabric. The Asphalt Sealant shall be an Emulsion or Asphalt Cement as directed by the Engineer or as shown on the plans.

   a) Emulsion A cationic asphalt emulsion, grade CRS-2 meeting requirements of 702-4101 "Cationic Asphalt Emulsion (CRS-2)" of the N.Y.S.D.O.T. Standard Specification.

   b) Asphalt Cement Asphalt cement shall be AC-5 meeting the requirements of Section 400, Bituminous Pavement, of the N.Y.S.D.O.T. Standard Specifications.

2. The Fabric shall be applied over the asphalt sealant and shall have the following properties:

a)	Minimum Weight	3.6 oz./sq.yd.
b)	Minimum Tensile Strength (as determined in accordance with A.S.T.M. Method D-1682-64)	90 lbs.
c)	Minimum elongation -at-break (as determined in accordance with A.S.T.M. Method D-1682-64)	55%
d)	Minimum Asphalt Retention	0.20 gals./sq.yd.

EQUIPMENT

The asphalt distributor shall be suitably metered and capable of spraying the asphalt sealant at the prescribed temperature and application rate. It shall be adjustable to give a uniform spray pattern over the entire width of application without dripping or skipping.

Hand spraying shall be kept to a minimum and limited to areas where a distributor cannot be used.

Mechanical fabric laydown equipment shall consist of a tractor unit capable of laying full rolls of fabric smoothly, without excessive wrinkles and/or folds.

INSTALLATION PROCEDURES

1. Pavement Preparation

a) The underlaying asphalt cement course shall be cleared of any dirt, dust and vegetation by either brooming or flushing with water before application or sealant.

b) The asphalt cement course shall then be cleared of all sharp or angular protrusions.

2. Application of Sealant

The asphalt sealant shall be uniformly spray applied at the rate of 0.25 to 0.30 gallons per square yard. Within street intersections or other areas where vehicle speed is commonplace, the application rate shall be reduced by 20 percent. The rate of application may be adjusted based on observations or membrane manufacturer's recommendations as directed by the Engineer.

The temperature of the asphalt emulsion at the time of application shall be 130°F. If hot asphalt is applied, the temperature of the asphalt cement shall be between 250° and 350°F.

The width of application shall be fabric width plus 2 to 6 inches. Asphalt spills shall be cleaned from pavement surface to avoid flushing and possible fabric movement.

The asphalt emulsion shall then be allowed to cure prior to placement of the fabric. Typical emulsion cure times are shown below.

TYPICAL EMULSION CURE TIMES

Temperature	Humidity Dry	Moderate	Humid
60°F	2 Hrs.	3 Hrs.	4 Hrs.
75°F	1 Hr.	2 Hrs.	3 Hrs.
90°F	30 Min.	1 Hr.	2 Hrs.

Mechanical fabric laydown equipment shall consist of a tractor unit capable of laying full rolls of fabric accurately, without excessive wrinkles and/or folds.

INSTALLATION PROCEDURES

1. Pavement Preparation

a) The underlying asphalt cement course shall be cleared of all dirt, dust and vegetation by either brooming or flushing with water before application of sealant.

b) The asphalt cement course shall then be cleared of all sharp or angular protrusions.

2. Application of Sealant

The asphalt sealant shall be uniformly spray applied at the rate of 0.25 to 0.30 gallons per square yard. Within street intersections or other areas where vehicle speed is compromised, the application rate shall be reduced by 20 percent. The rate of application may be adjusted based on observations or membrane manufacturer's recommendations as directed by the Engineer.

The temperature of the asphalt emulsion at the time of application shall be 130°F. If hot asphalt is applied, the temperature of the asphalt cement shall be between 350° and 390°F.

The width of application shall be fabric width plus 2 to 6 inches. Asphalt spills shall be cleaned from pavement surface to avoid flushing and possible fabric movement.

The asphalt emulsion shall then be allowed to cure prior to placement of the fabric. Typical emulsion cure times are shown below.

TYPICAL EMULSION CURE TIMES

Temperature	Dry	Humidity Moderate	Humid
60°F	2 Hrs.	3 Hrs.	4 Hrs.
70°F	1 Hr.	2 Hrs.	3 Hrs.
80°F	30 Min.	1 Hr.	2 Hrs.

If hot asphalt cement is applied, the placement of the fabric shall follow immediately behind the application of the hot asphalt cement.

3. Application of Fabric

The fabric shall be placed into the asphalt sealant with a minimum of wrinkles by using the tractor powered unit.

Wrinkles severe enough to cause folds shall be slit and layed flat. The fabric shall be broomed from center outward, moving in the direction of laydown to establish uniform contact with sealant.

Transverse and longitudinal joints shall be made by overlapping the fabric 1 to 3 inches with additional sealant applied at a rate of 0.20 gal./sq.yd. to the joint as required and then broomed.

After fabric has been applied and broomed the fabric shall be rolled with a pneumatic roller.

In the event that the sealant bleeds through the fabric before the asphalt courses are placed, it may be necessary to blot the sealant by spreading sand or hot mix over the affected areas. This will prevent any tendency for construction equipment to pick up the fabric when driving over it.

METHOD OF MEASUREMENT

The measurement for payment for nonwoven polypropylene membrane shall be the number of square yards of membrane placed in accordance with the plans or as approved by the Engineer.

BASIS OF PAYMENT

The unit price bid per square yard shall include the cost of pavement preparation, cleaning, asphalt sealant, sealant application, fabric, fabric application and all materials, labor and equipment necessary to complete the work.

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LRI